

PA 5920 - Skill Workshop
Intro Data Visualization: Telling Stories with Numbers
How to make highly effective figures and tables to communicate data

PA 5920 - - Spring semester 2016 – 1.5 credit
Monday/Wednesday sec 001 2:30 pm to 3:45 pm HHHCtr 85

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Prerequisites: PA 5031 or similar courses recommended but not required

Introduction

Presenting information is a crucial skill for professional development in public policy. Whether working in a small NGO or big federal agency, all Humphrey alumni have to deal with presenting information at some point of their careers. Being able to summarize and create compelling – and honest – data visualization is almost as indispensable as good writing; an effective figure or table can make an argument for itself, and visualizing the right information is central to making decisions.

This course is designed to be an important tool for Capstones and Professional papers, but most importantly, a practical tool for your career development. The course is designed to teach you how to organize and present public-policy-related data in the most effective way. The lectures discuss some of the theories and elements of graphs and tables design, but an important part of the classes will be practical: learning how to actually create tables, graphs and organize data.

Course Description

The goal of the class is to provide Humphrey students with the tools for communicating quantitative information in an intelligent, effective and persuasive way. After successfully completing the course students should be able to:

1. Determine which types of statistical measures are most effective for each type of data and message;
2. Determine which types of design to use for communicating quantitative information;
3. Design graphs and tables that are intelligent and compelling for communicating quantitative information; and
4. Understand different types of information and how to use and communicate data effectively.

The class will have a practical approach, combining discussion and practical exercises. A typical class will start with an introduction of the topic and examples of tables and graphs that have been poorly designed. Student will be asked about the problems they perceive and the ways to fix them. Several

examples of improvements will be shown, and each student will work on a computer to learn how to design the figures using Excel and R. The course is designed to be like a walk-through, starting from collecting and organizing data and ending with advanced graph designs.

All lectures will be done in a computer lab to allow for practical exercises.

Required Texts

Few, Stephen (2012) “Show Me the Numbers: Designing Tables and Graphs to Enlighten.” Oakland, California: Analytic Press. ISBN 978-0970601971.

Outline

Prior to the first class, all students should have filled out the survey about their current Excel (ex. do you know how do make pivot tables?) knowledge and familiarity with R or Stata.

The reading should all be done before class.

1. January 16, 2018: Introduction to the course and data visualization

Reading: Few, Chapter 1: Introduction

Chapter 5: Visual Perception and Graphical Communication

- Description of the course
- Examples of poorly and well-designed figures and tables
- Visual Perception and Human Memory

2. January 18, 2018: Speaking and writing about numbers

Reading: United Nations (2005) “Making data meaningful: a guide to writing stories about numbers”

Optional Reading: Jane E. Miller. (2004) “The Chicago Guide to Writing about Numbers,” Chapter 2: Seven Basic Principles and Chapter 10: Writing about Data and Methods

- Steps to write a statistical story: Journalist style, leading paragraphs, following paragraphs, tips for good writing technique.
- The Seven Basic principles.
- Choosing cutoffs and digits.

[In Class Exercise: Exercise on writing about numbers](#)

First assignment handed out (due Thursday January 25): Write a short memo telling a story using the data. Use a headline; the memo should have 3-4 paragraphs.

3. January 23, 2018: Preparing Data for Charting Part 1/2

- Organize and clean data, relabel variables as necessary, and look for impossible and improbable values. Decide how to handle missing data.
- Analyze and summarize data for charting using Excel Functions

4. January 25, 2018: Preparing Data for Charting Part 2/2

- Organize and clean data, relabel variables as necessary, and look for impossible and improbable values. Decide how to handle missing data.
- Analyze and summarize data for charting using Excel Functions

Assignment 2 handed out: Excel exercises in organizing data to find patterns.

Assignment 1 is due on Moodle by Thursday January 25 at the beginning of class

5. January 30, 2018: Excel Shortcuts and Thinking about Data

Reading: *Few*, Chapter 2: Simple Statistics to Get you Started

Optional reading: *Nathan Yau* (2011), Chapter 1

- Thinking about quantitative data: types of data and relationships.
- Review of measures: average, ratio, variation, correlation, percentiles, standard deviation and histogram.

In Class Exercise: Excel Basics for Data Analysis

6. February 1, 2018: Data Management Continued and When to Use Graphs and Tables

Readings: *Cairo, Alberto* (2012). "The Functional Art". Pages 5-17.

Readings: *Few*, Chapters 3 (Differing roles of tables and graphs) and 6 (Fundamental variations of graphs)

- Downloading data and organizing it in Excel
- Useful functions in Excel: "\$", "if", "Sumproduct," Pivot tables.
- Basics of Excel graphs

- Introduction to tables: When to use a table and fundamental variations of tables.
- Introduction to figures: When to use figures and how to choose the right one.
- Fundamental variations of graphs: nominal comparison, time series, ranking, part-to-whole, deviation, distribution and correlation.

In Class Exercise: Organizing Data and Pivot Tables

Assignment 2 is due on Moodle by Friday February 2

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7. February 6, 2018: Best practices in design of effective tables

Readings: Few, Chapter 3 and 6 (Table design)

Optional Reading: Miller, chapter 6: Creating effective tables

- The Data-to-ink ratio advice.
- Best practices in table design: Titles, Arranging data, Filling, Rules and gridlines, Summarizing relationships, Number precision.

[In Class Exercise: Table Exercises, and Practice in Table Design.](#)

Assignment 3 assigned. Criticize and improve different tables.

8. February 8, 2018: Graphs to enlighten

Readings: Few, Chapter 9: General graph design and Few, Chapter 10: Component-level graph design

- Problems with 3D figures and pie charts.
- Best practices in scatterplots and lines.
- Advanced techniques using scatterplots.

[In Class Exercise: Scatter Plot and Line Graphs Design handout](#)

9. February 13, 2018: Best practices for bars

Assignment 3 due.

Readings: Few, Chapter 10: Component-level graph design

- Secondary data component design.
- Best practices for bars.
- Advanced techniques using bars: how to choose the right orientation, proximity, fills, axis, etc.

[In Class Exercise: Bar Graph Design handout](#)

10. February 15, 2018: Advanced solutions for multiple variables

Readings: Few, Chapter 11: Displaying many variables at once and Few, Chapter 12: Silly graphs that are best forsaken

- Combining multiple units of measure in one graph.
- Combining graphs in series of small multiples.
- Advanced solutions in part-to-whole: Stacked graphs.

In Class Exercise: Advanced solutions for multiple variables handout
(if there is time: Descriptive statistics and basic regressions in Excel)

Assignment 4 assigned: Criticize, improve, and create different graphs.

11. February 20, 2018: Final Memo Ideas

See Moodle for instructions

- class time allocated to work on assignment 4

12. February 22, 2018: Introduction to R part 1

Assignment 4 due February 25.

- Rstudio
- Using R Scripts and commenting
- Installing and loading R Packages
- R as a calculator
- Functions in R
- Vectors

13. February 27, 2018: Introduction to R part 2

- Importing data
- Summary statistics
- Data management

Assignment 5 assigned

14. March 1, 2018: Introduction to R part 3

- Graphics using ggplot2 function

15. March 6, 2018: General Display theory

(TBD)

Assignment 5 due

16. March 8, 2018: Last day of class

- Slides of most common mistakes/problems with past memos
- Review of memo grading rubric

Students must print draft of final assignment so that partner can comment on figures

In-class exercise:

- Comment and respond to partner's draft final project (40 minutes)
- Rate the quality of the feedback you received on scale from 1 (excellent)-5 (very poor).

Final Memo will be due on Moodle March 10

Assignments:

Students will have to turn in four assignments and one short report.

The **first assignment** requires students to criticize a research brief using data and write a short memo telling a story using the data.

The **second assignment** requires students to work in Excel organizing data and finding patterns using some functions and data analysis techniques.

The **third and fourth** assignments require criticizing graphs and tables provided by the instructor. Students will have to explain the problems they detect and suggest solutions to correct them. Also, student will be required to analyze some data and create tables/graphs in Excel.

The **fifth** assignment requires you to reverse engineer a figure using R. You will need to submit a stand-alone script (so including the necessary R packages). The only thing I will need to change to see if your code works is the directory path.

The **final report** requires students to write a short 2-4 page memo (double spaced, plus tables and graphs) using data. Students will have to choose arguments and support them using tables and graphs.

Grading:

Grading will be either A/F or S/N.

Grade breakdown:

- 12% First assignment
- 12% Second assignment
- 12% Third assignment
- 12% Fourth assignment
- 12% Fifth assignment
- 40% Final report

Grading levels are as follows:

- A 100-93%
- A- 92-90%
- B+ 89-87%
- B 86-83%
- B- 82-80%
- C+ 79-77%
- C 76-73%
- C- 72-70%
- D+ 69-67%
- D 66-63%
- D- 62-60%
- F <60%

Please note: Unless prior arrangements have been made, late assignments will be penalized one unit immediately and then again for each 24 hours after the due date/time. For example, an “A” paper will be lowered to an “A-” if turned in after the due date/time, and then to a “B+” 24 hours after the due date/time.

Additional References

<http://www.storytellingwithdata.com/>

<http://policyviz.com/>

Alberto Cairo. (2012). “The Functional Art: An introduction to information graphics and visualization”. New Riders. ISBN 978-0321834737

Jane Miller. (2004). “The Chicago Guide to Writing about Numbers”. University Of Chicago Press. ISBN 978-0226526317

Edward R. Tufte. (2001, 2nd edition) "The Visual Display for Quantitative Information." Connecticut: Graphic Press. ISBN 978-0961392147

Dona Wong. (2010). “The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of Presenting Data, Facts, and Figures.” New York: Norton. ISBN 978-0393072952.

Nathan Yau (2011). "Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics." Wiley ISBN 978-0470944882

See the Moodle site for recommended websites.

Policies

Disabilities:

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations. If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course. For more information, please see the DS website, <https://diversity.umn.edu/disability/>.

Mental Health and Stress Management:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website at <http://www.mentalhealth.umn.edu>.

Remember that there are advisors in the Humphrey Student Services office who are trained and experienced counselors. They are available at very short notice to address any concerns you have and provide further resources within the University. Humphrey Student Services, HHH 280, 612-624-3800

Scholastic misconduct:

Is broadly defined as any act that violates the right of another student in academic work or that involves misrepresentation of your own work. Scholastic dishonesty includes, (but is not necessarily limited to): cheating on assignments or examinations; plagiarizing, which means misrepresenting as your own work any part of work done by another; submitting the same paper, or substantially similar papers, to meet the requirements of more than one course without the approval and consent of all instructors concerned; depriving another student of necessary course materials; or interfering with another student's work.

Incompletes:

This course follows the Humphrey School policy regarding incompletes. An incomplete will only be granted after the Professor and the student have mutually agreed upon a timetable (written contract) for completion of coursework. An incomplete must be requested in advance, and the Humphrey Institute incompletes form must be filled out.

Additional Policies:

For further information on the following policies, please see:

http://policy.umn.edu/Policies/Education/Education/Syllabusrequirements_APPA.html

- Student Conduct Code
- Use of Personal Electronic Devices in the Classroom
- Scholastic Dishonesty
- Makeup Work for Legitimate Absences
- Appropriate Student Use of Class Notes and Course Materials
- Grading and Transcripts
- Sexual Harassment
- Equity, Diversity, Equal Opportunity and Affirmative Action
- Academic Freedom and Responsibility